CLAIMS

I claim:

1. A method for correcting light intensities from blood vessels and background tissue beneath tissue surface in a living being that are exposed to polarized light from an orthogonal polarized spectral (OPS) imaging system, said method comprising the steps of:

emitting polarized light at tissue comprising blood vessels and background tissue, the blood vessels being located at a focal plane of said OPS imaging system and wherein a foreground region is formed between said focal plane and the tissue surface;

collecting de-polarized light that has impacted the blood vessels and that has experienced scattering within said foreground region, said de-polarized light emerging from the tissue surface;

generating a first image based on said collected de-polarized light;

estimating the intensity of light scattered in the foreground region; and

subtracting said intensity of light scattered in the foreground region from said first image to generate a corrected image based on focal plane light intensities.

2. The method of Claim 1 wherein said method of estimating the intensity of light scattered in the foreground region comprises:

generating a probability function based on a photon of said de-polarized light originating from said focal plane and scattering within said foreground region;

centering said probability function along an axis within said focal plane and multiplying said probability function with said first image to form a light intensity of scattered light; and

summing all of said scattered light intensities from said focal plane;

3. The method of Claim 2 further comprising the step of inputting said scattered light intensities, said focal plane light intensities, the absorptivity of hemoglobin and the diameter of said blood vessels into Beer's Law to determine hemoglobin concentration.

4. The method of Claim 2 wherein said steps of centering said probability function along an axis within said focal plane and multiplying said probability function with said first image to form a light intensity of scattered light and summing all of said scattered light intensities from said focal plane comprises utilizing the following relationship;

$$I_s(x) = \int_{image} (dx_i)^2 P_s(|x - x_i|, z_f) \cdot I^M(x_i)$$

wherein
x = an axis within the focal plane;
$I_s(x)$ = the light intensity of scattered light;
P_s = probability function based on a photon of said de-polarized light originating from the focal plane at a location x_i along said x axis; and
$I^M(x)$= said collected de-polarized light that has impacted the blood vessels and that has experienced scattering within said foreground region and emerged from the tissue surface.

5. The method of Claim 4 wherein said step of subtracting said scattered light intensities from said first image to determine focal plane light intensities comprises utilizing the following relationship:

$$I_f(x) = \frac{I^M(x) - I_s(x)}{\exp(-\mu_t z_f)}$$

wherein,
$I_f(x)$ = focal plane light intensities;
μ_t = is the transport coefficient of the foreground region; and
z_f = the distance between said foreground region and the tissue surface.

6. The method of Claim 5 further comprising the determining the hemoglobin concentration in the blood vessel using the following relationship:

$$[Hb] = -\frac{1}{\alpha D}\log\left(\frac{I_f(x_v)}{I_f(x_b)}\right) = -\frac{1}{\alpha D}\log\left(\frac{I^M(x_v) - I_s(x_v)}{I^M(x_b) - I_s(x_b)}\right)$$

wherein,
[Hb] = concentration of hemoglobin;
α = absorptivity of hemoglobin;
D = diameter of the blood vessel
$I_f(x_v)$ = focal plane light intensity evaluated at vessel x-axis position;
$I_f(x_b)$ = focal plane light intensities evaluated at background x-axis position;
$I_s(x_v)$ = the light intensity of scattered light evaluated at vessel x-axis position;
$I_s(x_b)$ = the light intensity of scattered light evaluated at background x-axis position;
$I^M(x_v)$= said collected de-polarized light that has impacted the blood vessels and that has experienced scattering within said foreground region and emerged from the tissue surface evaluated at vessel x-axis position; and
$I^M(x_b)$= said collected de-polarized light that has impacted the blood vessels and that has experienced scattering within said foreground region and emerged from the tissue surface evaluated at background x-axis position.